

# 02-SC-002, Project Engineering Design (PED), Various Locations

(Changes from the FY 2004 Congressional Budget Request are denoted with a vertical line in the left margin.)

## 1. Construction Schedule History

	Fiscal Quarter				Total Estimated Cost <sup>a</sup> (\$000)
	A-E Work Initiated	A-E Work Completed	Physical Construction Start	Physical Construction Complete	
FY 2002 Budget Request ( <i>Preliminary Estimate</i> ) .....	2Q 2002	3Q 2004	N/A	N/A	14,000
FY 2003 Budget Request .....	2Q 2002	3Q 2003	N/A	N/A	15,000
FY 2004 Budget Request .....	2Q 2002	3Q 2003	N/A	N/A	20,000
FY 2005 Budget Request ( <i>Current Estimate</i> ) .....	2Q 2002	4Q 2004	N/A	N/A	19,844

## 2. Financial Schedule

(dollars in thousands)

Fiscal Year	Appropriations	Obligations	Costs
2002	3,000	3,000	1,547
2003	11,850	11,850	10,436
2004	2,982	2,982	4,905
2005	2,012	2,012	2,956

## 3. Project Description, Justification and Scope

This PED request provides for Title I and Title II Architect-Engineering (A-E) services for projects related to the establishment of user centers for nanoscale science, engineering, and technology research. These funds allow designated projects to proceed from conceptual design into preliminary design (Title I) and definitive design (Title II). The design effort will be sufficient to assure project feasibility, define the scope, provide detailed estimates of construction costs based on the approved design and working drawings and specifications, and provide construction schedules including procurements. The design effort will ensure that construction can physically start or long-lead procurement items can be procured in the fiscal year in which Title III construction activities are funded.

<sup>a</sup> . . . Based on the results of peer review, the total design cost is \$19,844,769, reduced from the FY 2004 President's Request of \$20,000,000 due to the general reduction and rescission in FY 2003 and the rescission in FY 2004. The full Total Estimated Cost for each of the four currently proposed NSRC construction projects is identified in the FY 2005 construction datasheets.

Updated PED design projects are described below. Some changes may occur due to continuing conceptual design studies or developments prior to enactment of an appropriation. These changes will be reflected in subsequent years.

### Nanoscale Science Research Centers (NSRCs)

To support research in nanoscale science, engineering, and technology, the U.S. has constructed outstanding facilities for *characterization and analysis* of materials at the nanoscale. Most of these world-class facilities are owned and operated by BES. They include, for example, the synchrotron radiation light source facilities, the neutron scattering facilities, and the electron beam microscope centers. However, world-class facilities that are widely available to the scientific research community for nanoscale *synthesis, processing, and fabrication* do not exist. NSRCs are intended to fill that need. NSRCs will serve the Nation's researchers and complement university and industrial capabilities in the tradition of the BES user facilities and collaborative research centers. Through the establishment of NSRCs affiliated with existing major user facilities, BES will provide state-of-the-art equipment for materials synthesis, processing, and fabrication at the nanoscale in the same location as facilities for characterization and analysis. NSRCs will build on the existing research and facility strengths of the host institutions in materials science and chemistry research and in x-ray and neutron scattering. This powerful combination of colocated fabrication and characterization tools will provide an invaluable resource for the Nation's researchers.

In summary, the purposes of NSRCs are to:

- provide state-of-the-art nanofabrication and characterization equipment to in-house and visiting researchers,
- advance the fundamental understanding and control of materials at the nanoscale,
- provide an environment to support research of a scope, complexity, and disciplinary breadth not possible under traditional individual investigator or small group efforts,
- provide a formal mechanism for both short- and long-term collaborations and partnerships among DOE laboratory, academic, and industrial researchers,
- provide training for graduate students and postdoctoral associates in interdisciplinary nanoscale science, engineering, and technology research,
- provide the foundation for the development of nanotechnologies important to the Department.

Centers have been proposed by: Argonne National Laboratory (ANL), Brookhaven National Laboratory (BNL), Lawrence Berkeley National Laboratory (LBNL), Oak Ridge National Laboratory (ORNL), and a consortium of Los Alamos National Laboratory (LANL) and Sandia National Laboratory (SNL).

Based on peer review of the Center proposals, PED funding has been provided for BNL, LBNL, ORNL, and LANL/SNL. Funding for the ANL Center is included as a Major Item of Equipment beginning in FY 2004. Construction funding is also requested for BNL, LBNL, ORNL, and LANL/SNL in FY 2005.

## FY 2002 Proposed Design Projects

### 02-01: Center for Nanoscale Materials – Argonne National Laboratory

Fiscal Quarter				Total Estimated Cost (Design Only) (\$000)	Full Total Estimated Cost Projection (\$000)
A-E Work Initiated	A-E Work Completed	Physical Construction Start	Physical Construction Complete		
N/A	N/A	N/A	N/A	0 <sup>a</sup>	0 <sup>a</sup>

Fiscal Year	Appropriations	Obligations	Costs
2002	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
2003	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>

The Center for Nanoscale Materials (CNM) at ANL will consist of conventional facilities, fabrication facilities, characterization instruments, computational capabilities, and a beamline at the Advanced Photon Source (APS). The CNM will be attached to the APS at a location not occupied by one of the standard Laboratory-Office Modules that serve the majority of the APS sectors. The CNM is being coordinated with a State of Illinois effort. The State of Illinois is providing design and construction funding in FY 2002-2004 for the building. For this reason, PED funding is not planned or requested for this effort.

### 02-02: The Molecular Foundry – Lawrence Berkeley National Laboratory

Fiscal Quarter				Total Estimated Cost (Design Only) (\$000)	Full Total Estimated Cost Projection (\$000)
A-E Work Initiated	A-E Work Completed	Physical Construction Start	Physical Construction Complete		
3Q 2002	1Q 2004	2Q 2004	1Q 2007	7,215 <sup>b</sup>	83,700

Fiscal Year	Appropriations	Obligations	Costs
2002	500 <sup>b</sup>	500 <sup>b</sup>	38
2003	6,715 <sup>b</sup>	6,715 <sup>b</sup>	5,263
2004	0	0	1,258
2005	0	0	656

<sup>a</sup> The FY 2002 Request included funding of \$1,000,000 in FY 2002 and FY 2003 for this project. Based on results of peer review, funding was not planned for FY 2002 or in the FY 2003 Request. The building portion of the project is being funded by the State of Illinois while DOE plans to fund capital equipment for the Center as one or more MIEs. The CNM is funded at \$10,000,000 in FY 2004 President's Request with a MIE TEC of \$36,000,000. Funding for the CNM MIE is continued in the FY 2005 Request at \$12,000,000.

<sup>b</sup> The FY 2004 Request identified \$500,000 for FY 2002 and \$6,800,000 for FY 2003. The FY 2003 funding was reduced by \$84,531 as a result of the general reduction and rescission. The project received construction funds in FY 2004.

The proposed Molecular Foundry at LBNL will be a new structure near the National Center for Electron Microscopy. The project includes an approximately 89,000 gross square foot research building, a separate approximately 6,000 gross square foot utility center, and special equipment to support nanoscale scientific research. The research building will be an advanced facility for the design, modeling, synthesis, processing, fabrication, and characterization of novel molecules and nanoscale materials. Space in the new facility will support studies in nanostructures by providing offices and laboratories for materials science, physics, chemistry, biology, and molecular biology. These laboratories, equipped with advanced instrumentation and staffed by full-time, dedicated staff scientists and technicians, will be user facilities, available to scientists from universities, industry, and government laboratories whose research proposals have been peer reviewed by a Proposal Study Panel. This combination of advanced equipment, collaborative staff, and breadth across disciplines will allow users to explore the frontiers of nanoscience. New and existing beamlines at the ALS, not part of this PED activity, will support efforts at the Molecular Foundry. Construction funding for this project was initiated in FY 2004.

#### 02-03: Center for Functional Nanomaterials – Brookhaven National Laboratory

Fiscal Quarter				Total Estimated Cost (Design Only) (\$000)	Full Total Estimated Cost Projection (\$000)
A-E Work Initiated	A-E Work Completed	Physical Construction Start	Physical Construction Complete		
4Q 2003	4Q 2004	3Q 2005	2Q 2008	5,982 <sup>a</sup>	79,700

(dollars in thousands)

Fiscal Year	Appropriations	Obligations	Costs
2002	0 <sup>a</sup>	0 <sup>a</sup>	0
2003	988 <sup>a</sup>	988 <sup>a</sup>	733
2004	2,982 <sup>a</sup>	2,982 <sup>a</sup>	2,949
2005	2,012 <sup>a</sup>	2,012 <sup>a</sup>	2,300

The Center for Functional Nanomaterials will be housed in a laboratory/office building of approximately 85,000 square feet that includes class 10 clean rooms, general laboratories, and wet and dry laboratories for sample preparation, fabrication, and analysis. There will be an initial set of equipment necessary to explore, manipulate, and fabricate nanoscale materials and structures. Also included are individual offices, seminar area, transient user space for visiting collaborators with access to computer terminals, conference areas, vending/lounge areas, and other support spaces. Equipment procurement for the project will include equipment needed for laboratory and fabrication facilities for e-beam lithography, transmission electron microscopy, scanning probes and surface characterization, material synthesis and fabrication, and spectroscopy. The building will incorporate human factors into its design to encourage peer interactions and collaborative interchange by BNL staff and research teams from collaborating institutions. In addition to flexible office and laboratory space it will provide

<sup>a</sup> The FY 2002 Request included \$1,000,000 in FY 2002 and \$2,000,000 in FY 2003 for this project. Based on results of peer review, funding was not planned for FY 2002 or in the FY 2003 Request. Based on the merits of a revised proposal, \$988,000 of PED funding was provided in FY 2003, \$2,982,000 was provided in FY 2004, and \$2,012,000 is requested in FY 2005. PED funding was reduced by \$12,000 as a result of the FY 2003 general reduction and rescission and by \$17,700 as a result of the FY 2004 rescission.

“interaction areas” a seminar room and a lunch room for informal discussions. This design approach is considered state-of-the-art in research facility design as it leverages opportunities for the free and open exchange of ideas essential to creative research processes. Based on the results of the FY 2001 peer review of the Center for Functional Nanomaterials, PED funding was not planned for FY 2002. Based on the review of a revised proposal, PED funding was provided in FY 2003 and FY 2004 and is requested in FY 2005.

#### 02-04: Center for Nanophase Materials Sciences – Oak Ridge National Laboratory

Fiscal Quarter				Total Estimated Cost (Design Only) (\$000)	Full Total Estimated Cost Projection (\$000)
A-E Work Initiated	A-E Work Completed	Physical Construction Start	Physical Construction Complete		
2Q 2002	1Q 2003	3Q 2003	4Q 2006	2,488 <sup>a</sup>	64,000

(dollars in thousands)

Fiscal Year	Appropriations	Obligations	Costs
2002	1,500 <sup>a</sup>	1,500 <sup>a</sup>	1,342
2003	988 <sup>a</sup>	988 <sup>a</sup>	1,121
2004	0	0	25

A major focus of the Center for Nanophase Materials Sciences (CNMS) will be the application of neutron scattering for characterization of nanophase materials. In this area, CNMS will be a world leader. With the construction of the new Spallation Neutron Source (SNS) and the upgraded High Flux Isotope Reactor (HFIR), it is essential that the U.S.-based neutron science R&D community grow to the levels found elsewhere in the world and assume a scientific leadership role. Neutron scattering provides unique information about both atomic-scale structure and the dynamics of a wide variety of condensed matter systems including polymers, macromolecular systems, magnetic and superconducting materials, and chemically complex materials, particularly oxides and hydrogen-containing structures. Consequently, the intense neutron beams at HFIR and SNS will make, for the first time, broad classes of related nanoscale phenomena accessible to fundamental study.

The CNMS building (approximately 80,000 gross square feet) will contain wet and dry materials synthesis and characterization laboratories; clean rooms and materials imaging, manipulation, and integration facilities in a nanofabrication research laboratory; computer-access laboratories for nanomaterials theory and modeling; and office space for staff and visitors. The CNMS facility will consist of a multi-story building for materials synthesis and characterization contiguous with a single-story structure for nanofabrication having Class 100, Class 1,000, and Class 10,000 clean areas. The latter portion of the facility will be built using a construction approach that will meet low electromagnetic field, vibration, and acoustic noise requirements for special nanofabrication and characterization equipment. Construction funding for this project was initiated in FY 2003.

<sup>a</sup> Funding of \$1,000,000 in FY 2003 and \$2,000,000 in FY 2004 was identified in the FY 2003 Request for this project. Based on the results of peer review, this project was funded at \$1,500,000 in FY 2002 and \$988,000 in FY 2003. PED funding was reduced \$12,000 as a result of the FY 2003 general reduction and rescission.

02-06: The Center for Integrated Nanotechnologies (CINT) – Sandia National Laboratories/Los Alamos National Laboratory

Fiscal Quarter				Total Estimated Cost (Design Only) (\$000)	Full Total Estimated Cost Projection (\$000)
A-E Work Initiated	A-E Work Completed	Physical Construction Start	Physical Construction Complete		
4Q 2002	2Q 2004	1Q 2004	3Q 2007	4,159 <sup>a</sup>	73,800

Fiscal Year	Appropriations	Obligations	Costs
2002	1,000 <sup>a</sup>	1,000 <sup>a</sup>	167
2003	3,159 <sup>a</sup>	3,159 <sup>a</sup>	3,319
2004	0	0	673

The Center for Integrated Nanotechnologies (CINT), jointly managed by the Sandia National Laboratories (SNL) and Los Alamos National Laboratory (LANL), has as its primary objective the development of the scientific principles that govern the performance and integration of nanoscale materials, thereby building the foundations for future nanotechnologies. CINT will consist of a core research facility of approximately 95,000 square feet to be located in an unrestricted area just outside the restricted area at SNL and two smaller “gateway” facilities located on the campuses of SNL and LANL. These gateways will provide office space and, in the case of the LANL gateway limited amounts of laboratory space, for researchers who need access to specialized facilities located on these campuses. The SNL gateway will use existing space in SNL’s Integrated Materials Research Laboratory; the LANL gateway will require construction of a small building of approximately 34,000 square feet. The CINT gateway to SNL will focus on specialized microfabrication and nanomaterials capabilities and expertise. The CINT gateway to LANL will focus on connecting CINT researchers to the extensive biosciences and nanomaterials capabilities at LANL. The core research facility and the gateways will be managed as one integrated facility by a single management structure led by SNL. The CINT will focus on nanophotonics, nanoelectronics, nanomechanics, and functional nanomaterials. The Center will make use of a wide range of specialized facilities, including the Los Alamos Neutron Science Center and the National High Magnetic Field Laboratory at LANL, and the Microelectronics Development Laboratory and the Compound Semiconductor Research Laboratory at SNL. Construction funding for this project was initiated in FY 2003.

The CINT core facility in Albuquerque will provide an open environment readily accessible by students and visitors, including foreign nationals. This structure will house state-of-the-art clean rooms and an initial set of equipment for nanolithography, atomic layer deposition, and materials characterization along with general purpose chemistry and electronics labs and offices for Center staff and collaborators. The complex will require class 1,000 clean room space for nanofabrication and characterization equipment and an additional class 100 clean room space for lithography activities. This facility will also

<sup>a</sup> The FY 2002 Request included a total of \$1,000,000 in FY 2002 and \$2,000,000 in FY 2003 for the LANL and SNL components of this combined project. Based on results of peer review, current PED funding plan for the combined project is \$1,000,000 for FY 2002 and \$3,159,000 in FY 2003. PED funding of \$41,000 and construction funding of \$56,074 were reduced as a result of the FY 2003 general reduction and rescission.

require general purpose chemistry/biology laboratories and electronic and physical measurement laboratories. To house the Center staff, collaborators, Center-sponsored post docs, visiting students and faculty, and industry collaborators, offices and meeting rooms will be provided.

#### 4. Details of Cost Estimate <sup>a</sup>

(dollars in thousands)		
	Current Estimate	Previous Estimate
Design Phase		
Preliminary and Final Design costs (Design Drawings and Specifications) .....	14,844	15,000
Design Management costs (15.1% of TEC) .....	3,000	3,000
Project Management costs (10.1% of TEC) .....	2,000	2,000
Total Design Costs (100% of TEC) .....	19,844	20,000
Total, Line Item Costs (TEC) .....	19,844	20,000

#### 5. Method of Performance

Design services are obtained through competitively awarded fixed price contracts. M&O contractor staff may be utilized in areas involving security, production, proliferation, etc. concerns.

#### 6. Schedule of Project Funding

(dollars in thousands)					
	Prior Year Costs	FY 2003	FY 2004	FY 2005	Total
Facility Cost					
PED .....	1,547	10,436	4,905	2,956	19,844
Other project costs					
Conceptual design cost <sup>b</sup> .....	1,490	0	0	0	1,490
Total, Project Costs .....	3,037	10,436	4,905	2,956	21,334

<sup>a</sup> This cost estimate is based on direct field inspection and historical cost estimate data, coupled with parametric cost data and completed conceptual studies and designs when available. The cost estimate includes design phase activities only. Construction activities will be requested as individual line items on completion of Title I design.

<sup>b</sup> Only Conceptual Design Costs associated with the NSRCs are included. Other project costs are identified for individual NSRCs on the individual construction project data sheets for Project 03-R-312, Center for Nanophase Materials Sciences; Project 04-R-313, Molecular Foundry; Project 03-R-313, Center for Integrated Nanotechnologies; and 05-R-321, Center for Functional Nanomaterials.

